

# Self-Supporting High Performance Multi-Layer Insulation Technology Development (SSMLI) Project

Game Changing Development Program | Space Technology Mission Directorate (STMD)



## ABSTRACT

A new type of MLI—Integrated Multi-Layer Insulation (IMLI)—uses rigid, low-conductivity polymer spacers instead of netting to keep the radiation barriers separated. In addition to making the material stiff enough to support itself and advanced thermal shields, the spacers reduce the amount of heat leak to the tank. This project aims to perform ground testing to validate thermal and structural performance of Integrated Multi-Layer Insulation (IMLI).

## DETAILED DESCRIPTION

IMLI coupons have been outperforming traditional MLI. IMLI has better thermal performance—with some insulating properties improved by up to 37 percent (and analysis indicates that this could grow to 73 percent for a full system). IMLI reduces system uncertainty in thermal performance and lowers fabrication and installation costs. In addition, it has a more durable structure and was not damaged by the high acoustic noise levels associated with launching on a rocket.

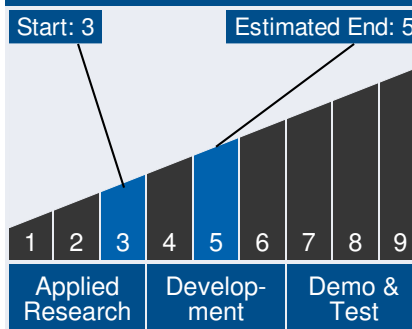
In 2013, the project conducted two tests with IMLI blankets applied to storage tanks: a thermal test and an acoustic test. The tests will have already been completed with traditional MLI. NASA Glenn conducted the thermal test in its Small, Multi-Purpose Research Facility (SMiRF), which simulates the vacuum and temperature extremes of space. The researchers tested IMLI that is supporting a Broad Area Cooling shield actively cooled by a cryocooler to see if IMLI can be used for the long-duration storage of liquid hydrogen with reduced boil-off.



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## Technology Maturity



## Management Team

### Program Executive:

- Ryan Stephan

### Program Manager:

- Stephen Gaddis

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NASA Marshall conducted the acoustic test, subjecting an IMLI blanket and shield identical to those used in the SMiRF tests to the vibrations and noise levels experienced during launch on a rocket. Use of this new insulation system supports NASA's goal to achieve zero boil-off, which would help enable longduration missions as NASA develops new capabilities for human space exploration. On Earth, this superinsulation may one day be used in homes and factories—reducing energy usage and furthering NASA's mission to drive advances in science that benefit everyone.

## Management Team (cont.)

### Project Manager:

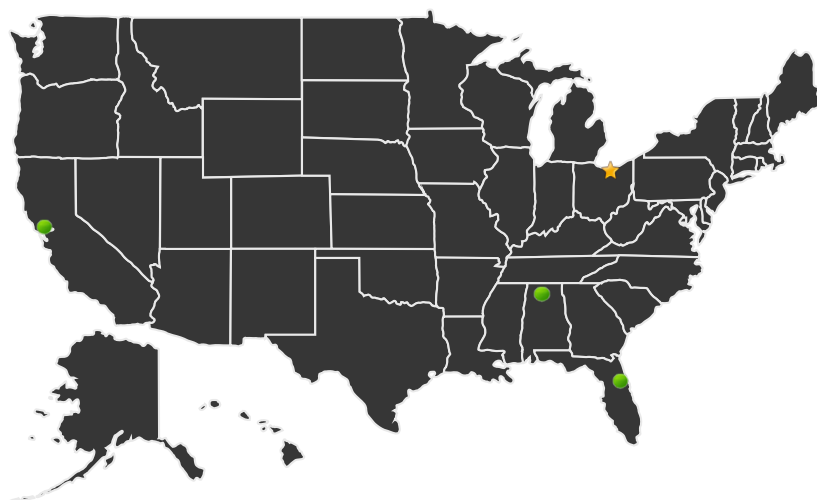
- Michael Doherty

## Technology Areas

### Primary Technology Area:

Thermal Management  
Systems (TA 14)

## U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States  
With Work

★ **Lead Center:**  
Glenn Research Center

### ● **Supporting Centers:**

- Ames Research Center
- Kennedy Space Center
- Marshall Space Flight Center

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## DETAILS FOR TECHNOLOGY 1

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### Technology Title

Self-Supporting High Performance Multi-Layer Insulation Technology Development (SSMLI)

### Technology Description

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